



## IA2 - FlexRay 2.1

*This course covers the FlexRay specification version 2.1*

### Objectives

- The course details the hardware implementation and describes the tests required to check the compliance of an equipment.
- The communication scheme which enables both Time and event-triggered communications is explained.
- The course focuses on error recovery mechanisms.
- Implementation examples are described through NXP and Philips existing devices.

A Lecroy analyser is used to capture and display FlexRay traffic.

- A lot of traces are included in the material.

A more detailed course description is available on request at [training@ac6-training.com](mailto:training@ac6-training.com)

### Prerequisites

- Experience of a digital bus is mandatory.

### Environnement du cours

- Cours théorique
  - Support de cours au format PDF (en anglais) et une version imprimée lors des sessions en présentiel
  - Cours dispensé via le système de visioconférence Teams (si à distance)
  - Le formateur répond aux questions des stagiaires en direct pendant la formation et fournit une assistance technique et pédagogique
- Au début de chaque demi-journée une période est réservée à une interaction avec les stagiaires pour s'assurer que le cours répond à leurs attentes et l'adapter si nécessaire

### Audience visée

- Tout ingénieur ou technicien en systèmes embarqués possédant les prérequis ci-dessus.

## Plan du cours

### INTRODUCTION TO FLEXRAY

- History, X-by-Wire
- Possible topologies
- Deterministic data transmission
- Partitioning
- Security mechanisms

### COMMUNICATION SCHEME

- Time and event-triggered communications
- Synchronized time-bases on macrotick basis
- Time division, slot duration and slot number configuration
- FTDMA dynamic part of a communication cycle
- Mini-slot allocation
- Frame format

- Message oriented addressing via identifiers
- Symbol transmission

## **NODE ARCHITECTURE**

- Bus controller
- SPI interface
- CPU parallel interface
- Node wake-up, power saving mode
- Media Access Control

## **TRANSFER PROTOCOL**

- Fault-tolerant and time-triggered services
- Repetitive vs spontaneous message scheduling
- Dedicated online diagnosis services
- Redundant transmission channels
- Robust coding and bit recognition scheme

## **PHYSICAL LAYER**

- Error detection and signaling
- Fault confinement in the Time Domain, Bus Guardian
- Signal level and bit representation
- Transmission medium

## **LINK LAYER**

- Fault confinement
- Error detection and signalling
- Message validation
- Message framing
- Scheduling and access control

## **TRANSPORT LAYER**

- Status signalling
- Frame and data handling
- Frame filtering and masking

## **ERROR MANAGEMENT SERVICE**

- Stopping communication
- Loss of synchronization
- Degradation concept
- Immediate passivation
- Error signalling

## **DEBUGGING A FLEXRAY APPLICATION**

- Compliance checklists
- Physical layer testing
- Protocol conformance verification